

# PATENT ABSTRACTS OF JAPAN

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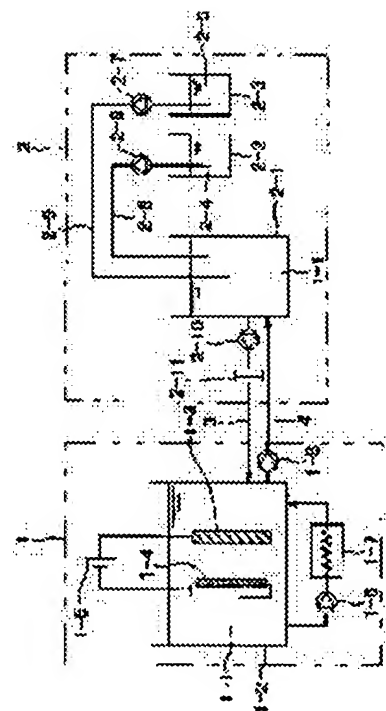
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## (54) PLATING DEVICE

### (57)Abstract:

**PROBLEM TO BE SOLVED:** To provide a plating device high in safety by setting a plating part and a control part in different chambers, conducting such dirty operations as maintenance work causing contamination in the chamber of the control part as far as possible, minimizing the maintenance operations in the plating part to avoid the contamination problem from the plating part and preventing the O<sub>2</sub> gas and H<sub>2</sub> gas from being discharged to a same space.

**SOLUTION:** This plating device consists of a plating part 1 and a control part 2 for regulating a plating soln. or the like. The plating part 1 holds a plating soln. 1-1 and is provided with a plating tank 1-2 in which an anode 1-3 is opposed to a cathode which constitutes a substrate 1-4 to be plated. The control part 2 is provided with a regulation tank 2-1 for regulating the composition and/or concentration of the plating soln. 1-1 and a replenishing mechanism for injecting a replenishment liq. into the plating soln. 1-1 in the regulation tank 2-1. A liq. circulating mechanism for circulating the plating soln. 1-1 between the regulation tank 2-1 of the control part 2 and the plating tank 1-2 of the plating part 1 is furnished, and the plating part 1 is set in the first chamber and the control part 2 in the second chamber.



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DETAILED DESCRIPTION

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[Detailed Description of the Invention]

[0001]

[Field of the Invention] Especially this invention relates to suitable plating equipment to perform metal plating to substrates, such as a semi-conductor wafer, in a semi-conductor manufacture process etc. about plating equipment.

[0002]

[Description of the Prior Art] In the semi-conductor manufacture process, the plating process is used abundantly as the object for wiring, or a \*\* with the film. Drawing 5 is drawing showing the configuration of this conventional kind of plating equipment. It consists of the plating section 1 and the Management Department 2, and the plating tub 1-2 is installed in the plating section 1, and the supplement tub 2-2 and the supplement tub 2-3 are installed in the Management Department 2 so that plating equipment may be illustrated.

[0003] Plating liquid 1-1 is held in the plating tub 1-2, in this plating liquid 1-1, the galvanized substrate 1-4 and the anode plate electrode (solubility) 1-3 with which the fixture was equipped counter, and are arranged, and the plating power source 1-5 is connected between this galvanized substrate 1-4 and the anode plate electrode 1-3. Moreover, a pump 1-6 and a thermoregulator 1-7 are formed, plating liquid 1-1 is sent to a thermoregulator 1-7 with a pump 1-6, and it is adjusted to the optimal solution temperature for galvanizing with this thermoregulator 1-7, and is returned to the plating tub 1-2.

[0004] The plating liquid (for example, H<sub>2</sub>SO<sub>4</sub> solution of predetermined concentration) 1-1 of predetermined concentration is held in the supplement tub 2-3. Plating liquid 2-5 is supplied to the plating tub 1-2 through piping 3 with a pump 2-7, and additive liquid 2-4 is held in the supplement tub 2-2, and it is supplied to the plating tub 1-2 through piping 4 with a pump 2-6. Plating liquid 2-5 new at the time of a standup is thrown into the plating tub 1-2, a presentation and concentration of the plating liquid 1-1 in the plating tub 1-2 are analyzed by the analysis apparatus which is not illustrated at the time of operation, and additive liquid 2-4 and plating liquid 2-5 are supplied to the plating tub 1-2 from the supplement tub 2-2 or the supplement tub 2-3 so that this presentation and concentration may be maintained by the predetermined value.

[0005] If a plating current is energized from the plating power source 1-5 between the galvanized substrate 1-4 and the anode plate electrode 1-3, the metal ion (for example, Cu<sup>2+</sup>) emitted from the soluble anode plate electrode (for example, phosphorus-containing copper electrode) 1-3 will adhere to the front face of the galvanized substrate 1-4, and the metal plating film will be formed. Since a metal ion is emitted into plating liquid 1-1 and it exhausts, the anode plate electrode 1-3 needs to exchange this anode plate electrode 1-3 periodically.

[0006] In the plating process using the above-mentioned plating equipment, plating liquid is a solution containing a metal ion, and if it adheres to a member, the metal ion will deposit and it will adhere. Moreover, the adhering metal may be transferred or invasion spread. Moreover, if plating liquid or its Myst is evaporated, a crystal will deposit and solid-state powder will produce it. These metallicity affix and crystalline powder serve as contamination of a clean room, a semi-conductor wafer, and a circuit ingredient.

[0007] In a semi-conductor manufacture process, if these plating processings are performed in a clean room when embedding the detailed wiring gutter formed in the front face of a semi-conductor wafer with metal plating, it is convenient in respect of production control etc. However, when the plating equipment which consists of the above-mentioned plating section 1 and the Management Department 2 is installed in a clean room, the supplement tub 2-2, the supplement tub 2-3, a liquid analysis apparatus (not shown), etc. of the Management Department 2 must be installed in a clean room, and the problem of the above contamination arises at the time of a maintenance.

[0008] Drawing 6 is drawing showing the example of a configuration of the plating equipment using the conventional insolubility anode plate electrode. Plating equipment consists of the plating section 1 and the Management Department

2, possesses the plating room 1-24 and equalizing tank 1-31 of closed mold in the plating section 1, and possesses the supplement tub 2-2, 2-3, 2-17, and 2-23 to the Management Department 2 so that it may illustrate. The plating room 1-24 of the plating section 1 was classified into anode plate side house 1-24a and cathode side house 1-24b by ion exchange membrane 1-25, on both sides of this ion exchange membrane 1-25, the anode plate side house was countered in the anode plate electrode 1-23 of insolubility, and countered cathode side house 1-24b in the galvanized substrate 1-4, and arranges.

[0009] The equalizing tank 1-31 was classified into anode plate side house 1-31a and cathode side house 1-31b by ion exchange membrane 1-27, on both sides of this ion exchange membrane 1-27, to anode plate side house 1-31a, countered the cathode electrode 1-29, and arranges the soluble anode plate electrode 1-28 at cathode side house 1-31b. Between the anode plate electrode 1-28 and the cathode electrode 1-29, the equalizing tank power source 1-33 is connected. Plating liquid was held in anode plate side house 1-31a, and the electrolytic solution is held in cathode side house 1-31b. If a predetermined electrical potential difference is impressed from the equalizing tank power source 1-33 between the anode plate electrode 1-28 and the cathode electrode 1-29, a metal ion will be eluted from the soluble anode plate electrode 1-28.

[0010] The plating liquid 1-1 of anode plate side house 1-31a of an equalizing tank 1-31 with a pump 1-14 Cathode side house 1-24b of the plating room 1-24 is supplied through a filter 1-16 and piping 1-20. The electrolytic solution of cathode side house 1-31b is supplied to anode plate side house 1-24a of the plating room 1-24 through a filter 1-17 and piping 1-21 with a pump 1-15. Moreover, the electrolytic solution 1-22 of anode plate side house 1-24a of the plating room 1-24 and the plating liquid 1-1 of cathode side house 1-24b return to cathode side house 1-31b of an equalizing tank 1-31, and anode plate side house 1-31a, respectively.

[0011] A predetermined electrical potential difference is impressed from the plating power source 1-5 between the anode plate electrode 1-23 of the plating room 1-24, and the galvanized substrate 1-4, and the metal plating film is formed in the front face of the galvanized substrate 1-4 by energizing a plating current to this anode plate electrode 1-23 and the galvanized substrate 1-4. By performing plating at the plating room 1-24, the metal ion (for example,  $\text{Cu}^{2+}$ ) consumed is filled up from an equalizing tank 1-31.

[0012] As mentioned above, although anode plate electrode exchange is not needed but the part maintenance activity decreases when using the electrode of insolubility for the anode plate electrode 1-23 of the plating section 1, the anode plate electrode 1-28 of an equalizing tank 1-31 needs a maintenance of exchange. It is not desirable on insurance for  $\text{O}_2$  gas to be emitted near the anode plate electrode 1-23 of the plating room 1-24, and for  $\text{H}_2$  gas to be emitted near the cathode electrode 1-29 of an equalizing tank 1-31, and to be emitted in the clean room these gas of whose is the same rooms.

[0013]

[Problem(s) to be Solved by the Invention] The plating section and the Management Department establish in the separate room, the activity which contamination generates in the dirty activity of a maintenance etc. does in the room in which the Management Department establishes as much as possible, the maintenance of the plating section carries out to the minimum in the plating equipment which this invention was made in view of the above-mentioned point, and consists of the plating section and the Management Department, and it aims at providing the plating equipment which occurs in the problem of contamination from the plating section and which is not things.

[0014] Moreover, it aims at  $\text{O}_2$  gas and  $\text{H}_2$  gas not being emitted to the same location, and offering the high plating equipment of safety.

[0015]

[Means for Solving the Problem] In order to solve the above-mentioned technical problem, invention according to claim 1 In the plating equipment which consists of the plating section which galvanizes, and the Management Department which performs adjustment of plating liquid etc., while the plating section holds plating liquid The plating tub which galvanizes by arranging the galvanized body as an anode plate electrode and cathode face to face is provided. The Management Department possesses the liquid supplement device in which supplement agent liquid is poured into the plating liquid of an equalizing tank and this equalizing tank which adjusts the component and/or concentration of plating liquid. The liquid circulator style which circulates the plating liquid of the equalizing tank of the Management Department and the plating tub of the plating section is prepared, the plating section is installed in the 1st room, and the Management Department is characterized by installing in the 2nd room.

[0016] Moreover, invention according to claim 2 is set to the plating equipment which consists of the plating section which galvanizes, and the Management Department which performs adjustment of plating liquid etc. The plating section possesses the plating room classified into the anode plate side house and the cathode side house by ion exchange membrane or porous membrane. While countering this anode plate side house in an insolubility anode plate

electrode, countering this cathode side house in the galvanized body as cathode, arranging on both sides of this ion exchange membrane or porous membrane and holding the electrolytic solution in this anode plate side house. Constitute so that it may galvanize by holding plating liquid in this cathode side house, and the Management Department possesses the equalizing tank classified into the anode plate side house and the cathode side house by the film with high ion selectivity. On both sides of the film with this high ion selectivity, counter this anode plate side house in a soluble anode plate electrode, counter this cathode side house in a cathode electrode, and it arranges. This anode plate side house holds the electrolytic solution in this cathode side house while holding plating liquid. Constitute so that elution of the metal ion may be carried out from this soluble anode plate electrode, and the liquid supplement device in which supplement this anode plate side house with plating liquid or/and an additive, and this cathode side house is supplemented with the electrolytic solution or/and an additive is provided. The liquid circulator style which circulates the electrolytic solution and plating liquid separately between the plating room of the plating section and the equalizing tank of the Management Department, respectively is prepared, the plating section is installed in the 1st room, and the Management Department is characterized by installing in the 2nd room.

[0017] As mentioned above, when the plating section was installed in the 1st room and the Management Department installed in the 2nd room. A dirty maintenance of impregnation of the additive for adjustment of the component of plating liquid, the extract of the plating liquid for mixing of other liquid, the temperature control of plating liquid, and component analysis, etc. Since it can carry out by concentrating in the 2nd room in which the Management Department different from the 1st room in which the plating section is installed is established, the problem of contamination hardly happens from the plating section.

[0018] Moreover, although O<sub>2</sub> gas occurs near the insolubility anode plate electrode of the plating room of the plating section and H<sub>2</sub> gas occurs near the cathode electrode of the equalizing tank of the Management Department since invention according to claim 2 adopts the above-mentioned configuration. The plating section and the Management Department become high plating equipment of safety by emitting to atmospheric air separately, without emitting O<sub>2</sub> gas and H<sub>2</sub> gas to the same location, since it is installed in the separate room.

[0019] Moreover, in plating equipment according to claim 1 or 2, the 1st room of invention according to claim 3 is a clean room, and it is characterized by the 2nd room being a utility room with an air cleanliness class lower than this clean room.

[0020] making into a clean room the 1st room in which the plating section is installed as mentioned above, and making into a utility room the 2nd room in which the Management Department is established -- the above -- since it concentrates by the utility room in which the Management Department is established and a dirty maintenance can be performed, contamination of a clean room is avoidable as much as possible.

[0021] Moreover, in claim 1 thru/or plating equipment given in any 1 of 3, it is characterized by installing the analysis apparatus which extracts some plating liquid of an equalizing tank and measures analysis and/or concentration of the component in the 2nd room.

[0022] Moreover, it is characterized by forming the thermoregulator which adjusts the temperature of the liquid held in an equalizing tank in claim 1 thru/or plating equipment given in any 1 of 3.

[0023] Moreover, the Management Department by which invention according to claim 4 is installed in the 2nd room to the plating section installed in the 1st room in claim 1 thru/or plating equipment given in any 1 of 3 being plurality is characterized by being one.

[0024]

[Embodiment of the Invention] Hereafter, the example of a gestalt of operation of this invention is explained based on a drawing. Drawing 1 is drawing showing the example of a configuration of the plating equipment concerning this invention. In drawing 1, the part which attached the same sign as drawing 5 being the same, or a considerable part is shown (suppose hereafter that it is the same also in other drawings). This plating equipment consists of the plating section 1 and the Management Department 2, as shown in drawing 1. The plating section 1 is installed in the 1st high room of air cleanliness classes, such as a clean room, and the Management Department 2 is established in the 2nd low room of air cleanliness classes, such as a utility room.

[0025] The plating section 1 possesses the plating tub 1-2 in which plating liquid 1-1 was held, and in the plating liquid 1-1 of this plating tub 1-2, the galvanized substrate 1-4 with which the soluble anode plate electrode 1-3 and a soluble fixture were equipped counters, and it is arranged. Between this anode plate electrode 1-3 and the galvanized substrate 1-4, the plating power source 1-5 is connected, and a plating current energizes from the anode plate electrode 1-3 to the galvanized substrate 1-4. Moreover, 1-6 is a pump, 1-7 is a thermoregulator, and the plating liquid 1-1 in the plating tub 1-2 is adjusted to suitable solution temperature to galvanize by being sent to a thermoregulator 1-7 with this pump 1-6, and is returned to the plating tub 1-2.

[0026] The Management Department 2 possesses an equalizing tank 2-1, the supplement tub 2-2, and the supplement tub 2-3, the plating liquid 1-1 adjusted to the equalizing tank 2-1 is held, additive liquid 2-4 is held in the supplement tub 2-2, and the plating liquid (for example, solution which made the copper sulfate of predetermined concentration the subject) 2-5 of predetermined concentration is held in the supplement tub 2-3. Additive liquid 2-4 is supplied to an equalizing tank 2-1 through piping 2-8 with a pump 2-6, and plating liquid 2-5 is supplied to an equalizing tank 2-1 through piping 2-9 with a pump 2-7.

[0027] The equalizing tank 2-1 and the plating tub 1-2 are connected for piping 3 and piping 4, the plating liquid 1-1 of an equalizing tank 2-1 is sent to the plating tub 1-2 through a filter 2-11 and piping 3 with a pump 2-10, and the plating liquid 1-1 of the plating tub 1-2 is sent to an equalizing tank 2-1 through piping 4 with a pump 1-8. That is, piping 3, a pump 2-10, a filter 2-11, piping 4, and a pump 1-8 constitute the plating liquid circulator style which circulates plating liquid 1-1 for between an equalizing tank 2-1 and the plating tubs 1-2.

[0028] In the plating equipment of the above-mentioned configuration, by impressing the electrical potential difference of a predetermined value from the plating power source 1-5, the metal ion (for example,  $\text{Cu}^{2+}$ ) emitted from the soluble anode plate electrode (for example, phosphorus-containing copper electrode) 1-3 adheres to the front face of the galvanized substrate 1-4, and the metal plating film is formed. Since a presentation, concentration, and plating volume of plating liquid 1-1 change in connection with continuation of plating operation, and the processing number of sheets of the galvanized substrate 1-4, according to the condition of the change, an equalizing tank 2-1 is supplemented with the additive liquid 2-4 of the supplement tub 2-2, or the plating liquid 2-5 of the supplement tub 2-3, and a presentation and concentration of plating liquid 1-1 are maintained to a predetermined value. In addition, as additive liquid 2-4 of the supplement tub 2-2, organic additive liquid (a polymer, a leveler, a carrier, and mixed solution of HCl) is used.

[0029] Since the dirty activity of the tuning of plating liquid which serves as exchange of the soluble anode plate electrode 1-3, and is performed at the Management Department 2 is done in the 2nd low room of an air cleanliness class in the 1st high room of an air cleanliness class by installing the plating section 1 in the 1st high room of air cleanliness classes, such as a clean room, as mentioned above, and establishing the Management Department 2 in the 2nd low room of air cleanliness classes, such as a utility room, a possibility of polluting the 1st room decreases. Moreover, since the Management Department 2 which needs an installation tooth space greatly is established in the 2nd low room of an air cleanliness class, the installation tooth space of the 1st precious high room of an air cleanliness class can be saved.

[0030] Drawing 2 is drawing showing other examples of a configuration of the plating equipment concerning this invention. The galvanized substrate 1-4 with which the substrate holder 1-9 was equipped with this plating equipment in the upper part of the plating tub 1-2 of the plating section 1 is arranged horizontally, and the soluble anode plate electrode 1-3 of this galvanized substrate 1-4 caudad prepares predetermined spacing, and it is arranged. Moreover, the substrate holder 1-9 is arranged by the seal member 1-10 so that the upper part of the plating tub 1-2 may be sealed. Plating liquid exhaust nozzle 1-3a of a large number which spout plating liquid 1-1 was formed in the anode plate electrode 1-3, and the back is covered by casing 1-11. That is, the nozzle which spouts plating liquid 1-1 toward the galvanized substrate 1-4 by the anode plate electrode 1-3 and casing 1-11 is constituted.

[0031] Moreover, a thermoregulator 2-15 and a pump 2-14 are formed in the equalizing tank 2-1 of the Management Department 2, and the temperature of the plating liquid 1-1 in an equalizing tank 2-1 can be maintained now to predetermined temperature. Moreover, the analysis apparatus 2-26 and the supplement tub 2-17 which analyze a presentation and concentration of the plating liquid 1-1 sent to the plating tub 1-2 from an equalizing tank 2-1 are prepared for the Management Department 2. The additive liquid 2-20 of this supplement tub 2-17 is supplied to an equalizing tank 2-1 through piping 2-19 with a pump 2-18.

[0032] The plating section 1 of the above-mentioned plating equipment is installed in the 1st high room of air cleanliness classes, such as a clean room, and the Management Department 2 is established in the 2nd low room of air cleanliness classes, such as a utility room. The plating liquid 1-1 of an equalizing tank 2-1 is sent to the plating tub 1-2 through a filter 2-11 and piping 3 with a pump 2-10, and blows off from plating liquid exhaust nozzle 1-3a of the anode plate electrode 1-3 toward the galvanized substrate 1-4. The inside of the plating tub 1-2 is full of plating liquid 1-1. By impressing the electrical potential difference of a predetermined value from the plating power source 1-5 between the anode plate electrode 1-3 and the galvanized substrate 1-4, a plating current energizes from the anode plate electrode 1-3 to the galvanized substrate 1-4, and the metal plating film is formed.

[0033] A presentation and concentration of the plating liquid 1-1 sent to the plating tub 1-2 from an equalizing tank 2-1 are analyzed by the analysis apparatus 2-26, and supply the supplement tub 2-3 to plating liquid 2-5 for additive liquid 2-4 to an equalizing tank 2-1 from the supplement tub 2-2 based on this analysis result. Moreover, additive liquid 2-20 is filled up from the supplement tub 2-17. There are a starter additive (Make-up additives) required in order to perform

dummy plating in additive liquid at the time of plating initiation and to form a black film in the front face of the anode plate electrode 1-3, and a replay NISSHA additive (Rèplenish additives) required at the time of continuation of plating operation. The additive liquid 2-20 of the supplement tub 2-17 is this starter additive liquid, and the additive liquid 2-4 of the supplement tub 2-2 is a replay NISSHA additive.

[0034] The same operation effectiveness as the plating equipment of a configuration of being shown in drawing 1 is acquired by installing the plating section 1 in the 1st high room of air cleanliness classes, such as a clean room, as mentioned above, and establishing the Management Department 2 in the 2nd low room of air cleanliness classes, such as a utility room. Since the pump 2-10 and filter 2-11 for plating liquid circulation, and a thermoregulator 2-15 are especially prepared for the Management Department here, it installs in the 2nd low room of an air cleanliness class and a maintenance can be performed in the 2nd room, it is desirable.

[0035] Drawing 3 is drawing showing other examples of a configuration of the plating equipment concerning this invention. This plating equipment possesses the plating room 1-24 of closed mold in the plating section 1, and in this plating room 1-24, the galvanized substrate 1-4 and the anode plate electrode 1-23 of insolubility counter, and it is arranged. And ion exchange membrane 1-25 has been arranged between the galvanized substrate 1-4 and the anode plate electrode 1-23, and the plating room 1-24 is divided to anode plate side house 1-24a and cathode side house 1-24b.

[0036] Moreover, the plating cistern 1-12 which holds plating liquid (for example, solution which made the copper sulfate the subject) 1-1, and the electrolytic-solution tub 1-13 which holds the electrolytic solution (for example, solution which made the sulfuric acid the subject) 1-22 are formed in the plating section 1. With a pump 1-14, the plating liquid 1-1 of the plating cistern 1-12 is supplied to cathode side house 1-24b through a filter 1-16 and piping 1-20, and the plating liquid 1-1 which overflowed from this cathode side house 1-24b returns to the plating cistern 1-12. Moreover, the electrolytic solution 1-22 of the electrolytic-solution tub 1-13 is supplied to anode plate side house 1-24a through a filter 1-17 and piping 1-21 with a pump 1-15, and the electrolytic solution 1-22 which overflowed from this anode plate side house 1-24a returns to the electrolytic-solution tub 1-13.

[0037] Moreover, the equalizing tank 2-25 was installed in the Management Department 2, ion exchange membrane 2-27 was installed in this equalizing tank 2-25, and the inside of this equalizing tank 2-25 is divided to anode plate side house 2-25a and cathode side house 2-25b. The soluble anode plate electrode (for example, phosphorus-containing copper electrode) 2-28 is arranged, the cathode electrode 2-29 counters on both sides of ion exchange membrane 2-27, and anode plate side house 2-25a is arranged at cathode side house 2-25b. Moreover, between the anode plate electrode 2-28 and the cathode electrode 2-29, the equalizing tank power source 2-35 is connected, and a predetermined current is energized from this anode plate electrode 2-28 to the cathode electrode 2-29.

[0038] Moreover, plating liquid 1-1 is held in anode plate side house 2-25a, and the electrolytic solution 1-22 is held in cathode side house 2-25b. Moreover, the supplement tub 2-17 to additive liquid 2-20 can be supplied [ additive liquid 2-4 ] now for the supplement tub 2-3 to plating liquid 2-5 to anode plate side house 2-25a from the supplement tub 2-2. Moreover, the electrolytic solution 2-36 can be supplied now to cathode side house 2-25b with a pump 2-24 from the supplement tub 2-23.

[0039] Moreover, a pump 2-30 and a thermoregulator 2-32 are connected to anode plate side house 2-25a, and the plating liquid 1-1 of anode plate side house 2-25a is maintained to predetermined temperature. Moreover, a thermoregulator 2-33 is connected with a pump 2-31 at cathode side house 2-25b, and the electrolytic solution 1-22 of cathode side house 2-25b is maintained to predetermined temperature.

[0040] Cathode side house 2-25b of the electrolytic-solution tub 1-13 of the plating section 1 and the equalizing tank 2-25 of the Management Department 2 is connected for piping 5 and 6. The electrolytic solution 1-22 to which the concentration of cathode side house 2-25b was adjusted with the pump 2-34 is sent to the electrolytic-solution tub 1-13 by cathode side house 2-25b with delivery and a pump 1-19 in the electrolytic solution 1-22 of the electrolytic-solution tub 1-13, and the concentration of the electrolytic solution of the electrolytic-solution tub 1-13 is maintained to a predetermined value.

[0041] Moreover, anode plate side house 2-25a of the plating cistern 1-12 of the plating section 1 and the Management Department 2 is connected for piping 3 and piping 4. The plating liquid 1-1 with which the presentation of anode plate side house 2-25a and concentration were adjusted is sent to the plating cistern 1-12 through a filter 2-11 and piping 3 with a pump 2-21. The plating liquid 1-1 of the plating cistern 1-12 is sent to anode plate side house 2-25a through piping 4 with a pump 1-8, and maintains the plating liquid 1-1 of the plating cistern 1-12 to a predetermined component and concentration.

[0042] In the plating equipment of the above-mentioned configuration, if a plating current is energized from the plating power source 1-5 between the galvanized substrate 1-4 of the plating room 1-24 of the plating section 1, and the anode

plate electrode 1-23 of insolubility, the metal ion in the plating liquid 1-1 of cathode side house 1-24b (for example,  $\text{Cu}^{2+}$ ) will adhere to the front face of the galvanized substrate 1-4, and will form the metal plating film. During this plating,  $\text{O}_2$  gas is emitted near the anode plate electrode 1-23, and PH value of the electrolytic solution 1-22 in anode plate side house 1-24a falls.

[0043] If a current is energized from the equalizing tank power source 2-35 between the soluble anode plate electrode (for example, phosphorus-containing copper electrode) 2-28 of the equalizing tank 2-25 of the Management Department 2, and the cathode electrode 2-29. While a metal ion (for example,  $\text{Cu}^{2+}$ ) is eluted from the anode plate electrode 2-28 and the metal ion concentration of plating liquid 1-1 goes up,  $\text{H}_2$  gas is emitted near the cathode electrode 2-29, and PH value of the electrolytic solution 1-22 in cathode side house 2-25b goes up. A metal ion can be filled up by sending the high plating liquid 1-1 of this metal ion concentration to the plating cistern 1-12 of the plating section 1 with a pump 2-21.

[0044] The plating section 1 of the above-mentioned plating equipment is installed in the 1st high room of air cleanliness classes, such as a clean room, and the Management Department 2 is established in the 2nd low room of air cleanliness classes, such as a utility room. Since the anode plate electrode 1-23 of the plating room 1-24 is insolubility, the maintenance of the plating section 1 which did not exchange the anode plate electrode 1-23, and was installed in the 1st high room of an air cleanliness class becomes almost unnecessary. Moreover, the anode plate electrode 2-28 of an equalizing tank 2-25 is solubility, since it exhausts, it is necessary to exchange them periodically but, and since exchange of this dirty anode plate electrode 2-28 is performed in the 2nd low room of an air cleanliness class, it is satisfactory.

[0045] Moreover, although generating emission of the  $\text{O}_2$  gas is carried out near the anode plate electrode 1-23 of anode plate side house 1-24a of the plating room 1-24 and generating emission of the  $\text{H}_2$  gas is carried out near the cathode electrode 2-29 of an equalizing tank 2-25. As mentioned above, since the plating section 1 is installed in the 1st room and the Management Department 2 is established in the 2nd room, from there, these  $\text{O}_2$  gas and  $\text{H}_2$  gas can be separately emitted to atmospheric air, and are desirable on insurance.

[0046] Drawing 4 is drawing showing other examples of a configuration of the plating equipment concerning this invention. The point that this plating equipment differs from the plating equipment shown in drawing 3 is a point of having removed the electrolytic-solution tub 1-13 and the plating cistern 1-12 from the plating section 1 of the plating equipment of drawing 3. And while supplying plating liquid 1-1 to cathode side house 1-24b of the direct plating room 1-24 through a filter 2-11 and piping 8 with a pump 2-21 from anode plate side house 2-25a of the equalizing tank 2-25 of the Management Department 2, the plating liquid 1-1 which overflowed from this cathode side house 1-24b is returned to anode plate side house 2-25a of an equalizing tank 2-25 through piping 7.

[0047] Furthermore, while supplying the electrolytic solution 1-22 of cathode side house 2-25b of an equalizing tank 2-25 to anode plate side house 1-24a of the direct plating room 1-24 through a filter 2-37 and piping 9 with a pump 2-34, the electrolytic solution 1-22 which overflowed from anode plate side house 1-24a is returned to cathode side house 2-25b of an equalizing tank 2-25 through piping 10. Since  $\text{O}_2$  gas occurs near the anode plate electrode 1-23 of the insoluble solution of anode plate side house 1-24a at this time, gas drainage is carried out to piping 10 by the bleed valve 1-32.

[0048] And the plating section 1 is installed in the 1st high room of air cleanliness classes, such as a clean room, and the Management Department 2 is established in the 2nd low room of air cleanliness classes, such as a utility room. Since most devices which need a maintenance for the plating section 1 by doing in this way are lost and a configuration becomes still easier, the outstanding effectiveness that the operation effectiveness does not have a possibility of polluting the 1st room where an air cleanliness class is still higher, as compared with the plating equipment of drawing 3 is acquired.

[0049] In addition, in the plating equipment shown in drawing 3 and drawing 4, the ion exchange membrane 1-25 which divides the plating room 1-24 to anode plate side house 1-24a and cathode side house 1-24b may not be limited to ion exchange membrane, and may be porous membrane. Moreover, the ion exchange membrane 2-27 which divides the equalizing tank 2-25 of the Management Department 2 to anode plate side house 2-25a and cathode side house 2-25b is not limited to ion exchange membrane, and should just be high film of ion permselectivity.

[0050] Moreover, although the above-mentioned example showed the example which makes a clean room the 1st room in which the plating section 1 is installed in the plating equipment of a configuration of being shown in drawing 1 thru/or drawing 4, not to be limited to a clean room and what is necessary is just the high room or fields of an air cleanliness class, such as a clean booth, a clean bench, and a clean box.

[0051] Moreover, it is illustrating so that the plating power source 1-5 may be formed in this plating section 1 and it may install in the 1st room, but this plating power source 1-5 may be formed in the 2nd room in which the Management

Department 2 is established, and you may constitute from an example of a configuration of the plating equipment shown in above-mentioned drawing 1 thru/or drawing 4 so that electric power may be supplied from here. By carrying out like this, the maintenance of the plating power source 1-5 can be performed in the 2nd room in which the Management Department 2 is established. When using a battery especially for the plating power source 1-5, a maintenance of a dirty battery will be performed in the 2nd low room of an air cleanliness class, and it is desirable. [0052] Moreover, although it constitutes from an example of a configuration of the plating equipment shown in above-mentioned drawing 1 thru/or drawing 4 so that the one Management Department may be prepared to the one plating section 1 To two or more plating sections 1, the one Management Department 2 may be formed, two or more plating sections 1 may be installed in the 1st room, and the one Management Department 2 may be established in the 2nd room, and you may constitute so that two or more plating sections can be managed at the one Management Department.

[0053] Moreover, in the example of a configuration of the plating equipment shown in above-mentioned drawing 1 thru/or drawing 4, although omitted, devices which need a maintenance, such as a flow meter which measures the flow rate of liquid, such as plating liquid and the electrolytic solution, a pressure gage which measures a pressure, and a thermometer, are installed to the 2nd low room of an air cleanliness class in which the Management Department 2 is established. A fear of making by this the 1st high room of an air cleanliness class in which the plating section 1 was installed pollute with these maintenances disappears.

[0054] In addition, although the galvanized body was used as galvanized substrates, such as a semi-conductor wafer, in the example of a gestalt of the above-mentioned implementation, naturally it is not what is limited to a substrate.

[0055]

[Effect of the Invention] As explained above, according to invention given in each claim, the following outstanding effectiveness is acquired.

[0056] Since according to invention according to claim 1 to 4 the device which needs a maintenance is installed in the Management Department as much as possible, it enables it to manage the plating section with the maintenance of the need minimum, and the plating section is established in the 1st room and the Management Department is established in the 2nd room The plating equipment that the contamination from the plating section does not pollute with various kinds of maintenances of the Management Department the 1st room in which the plating section is installed few can be offered.

[0057] Moreover, according to invention according to claim 2, O<sub>2</sub> gas occurs near the insolubility anode plate electrode of the plating room of the plating section, H<sub>2</sub> gas occurs near the cathode electrode of the equalizing tank of the Management Department, but the plating section and the Management Department can offer the high plating equipment of safety by emitting to atmospheric air separately, without emitting O<sub>2</sub> gas and H<sub>2</sub> gas to the same location, since it is installed in the separate room. Moreover, since the anode plate electrode of the plating room of the plating section is used as an insolubility anode plate electrode, plating equipment without the need of doing a dirty anode plate electrode exchange activity in the 1st room in which the plating section was installed can be offered.

[0058] Moreover, since according to invention according to claim 3 the 1st room in which the plating section is installed is made into a clean room and the 2nd room in which the Management Department is established is made into a utility room, it is made to perform the maintenance with a possibility of polluting the clean room where an advanced air cleanliness class is demanded, by the utility room as much as possible, and contamination of a clean room can offer plating equipment avoidable as much as possible.

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[Translation done.]

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1. This document has been translated by computer. So the translation may not reflect the original precisely.
2. \*\*\*\* shows the word which can not be translated.
3. In the drawings, any words are not translated.

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CLAIMS

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[Claim(s)]

[Claim 1] In the plating equipment which consists of the plating section which galvanizes, and the Management Department which performs adjustment of plating liquid etc., while said plating section holds plating liquid The plating tub which galvanizes by arranging the galvanized body as an anode plate electrode and cathode face to face is provided. Said Management Department possesses the liquid supplement device in which supplement agent liquid is poured into the plating liquid of an equalizing tank and this equalizing tank which adjusts the component and/or concentration of plating liquid. It is plating equipment which prepares the liquid circulator style which circulates the plating liquid of the equalizing tank of said Management Department, and the plating tub of said plating section, installs said plating section in the 1st room, and is characterized by said Management Department installing in the 2nd room.

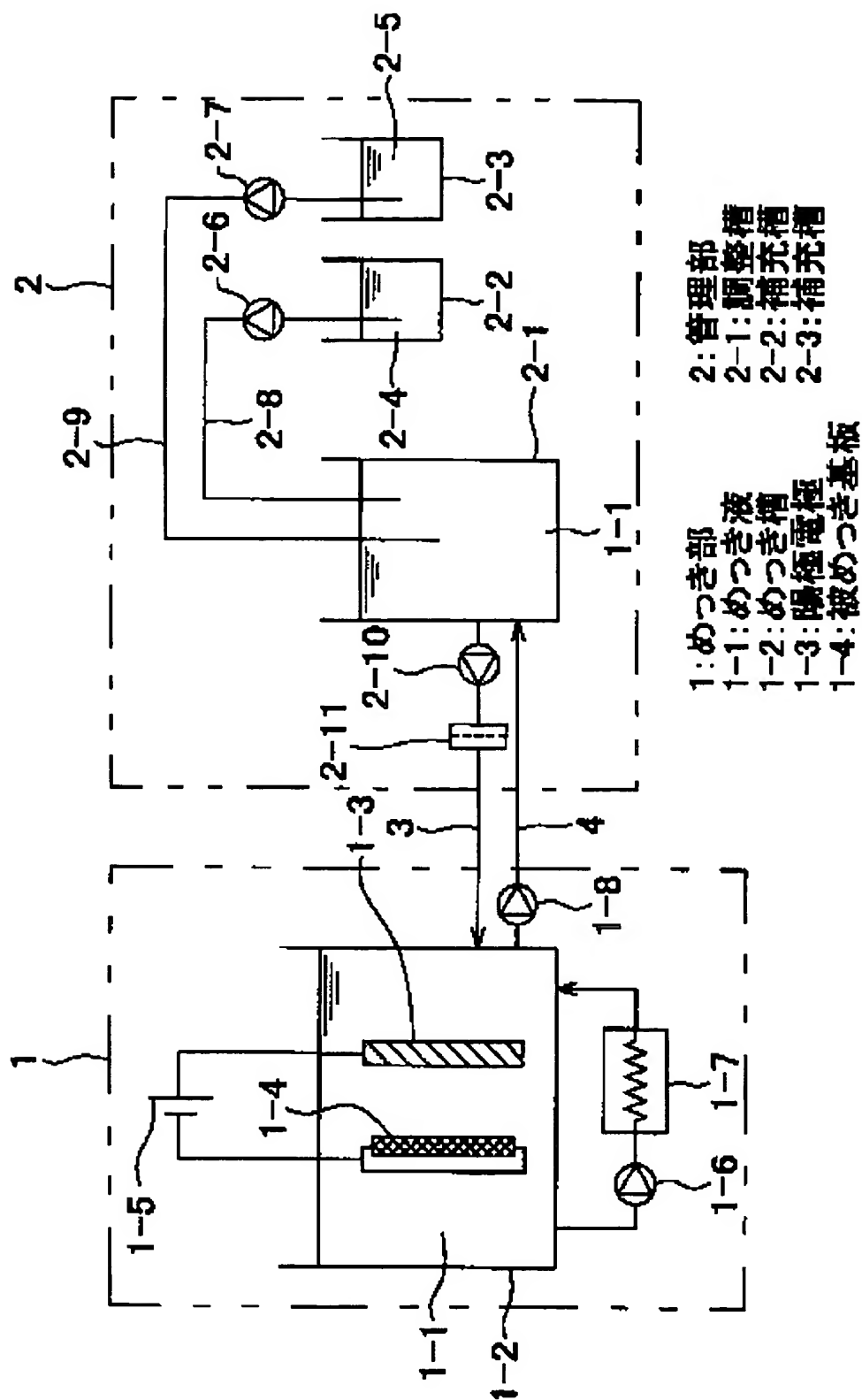
[Claim 2] In the plating equipment which consists of the plating section which galvanizes, and the Management Department which performs adjustment of plating liquid etc. Said plating section possesses the plating room classified into the anode plate side house and the cathode side house by ion exchange membrane or porous membrane. While countering this anode plate side house in an insolubility anode plate electrode, countering this cathode side house in the galvanized body as cathode, arranging on both sides of this ion exchange membrane or porous membrane and holding the electrolytic solution in this anode plate side house Constitute so that it may galvanize by holding plating liquid in this cathode side house, and said Management Department possesses the equalizing tank classified into the anode plate side house and the cathode side house by the film with high ion selectivity. On both sides of the film with this high ion selectivity, counter this anode plate side house in a soluble anode plate electrode, counter this cathode side house in a cathode electrode, and it arranges. This anode plate side house holds the electrolytic solution in this cathode side house while holding plating liquid. Constitute so that elution of the metal ion may be carried out from this soluble anode plate electrode, and the liquid supplement device in which supplement this anode plate side house with plating liquid or/and an additive, and this cathode side house is supplemented with the electrolytic solution or/and an additive is provided. It is plating equipment which prepares the liquid circulator style which circulates said electrolytic solution and plating liquid separately between the plating room of said plating section, and the equalizing tank of the Management Department, respectively, installs said plating section in the 1st room, and is characterized by said Management Department installing in the 2nd room.

[Claim 3] It is plating equipment which said 1st room is a clean room and is characterized by said 2nd room being a utility room with an air cleanliness class lower than this clean room in plating equipment according to claim 1 or 2.

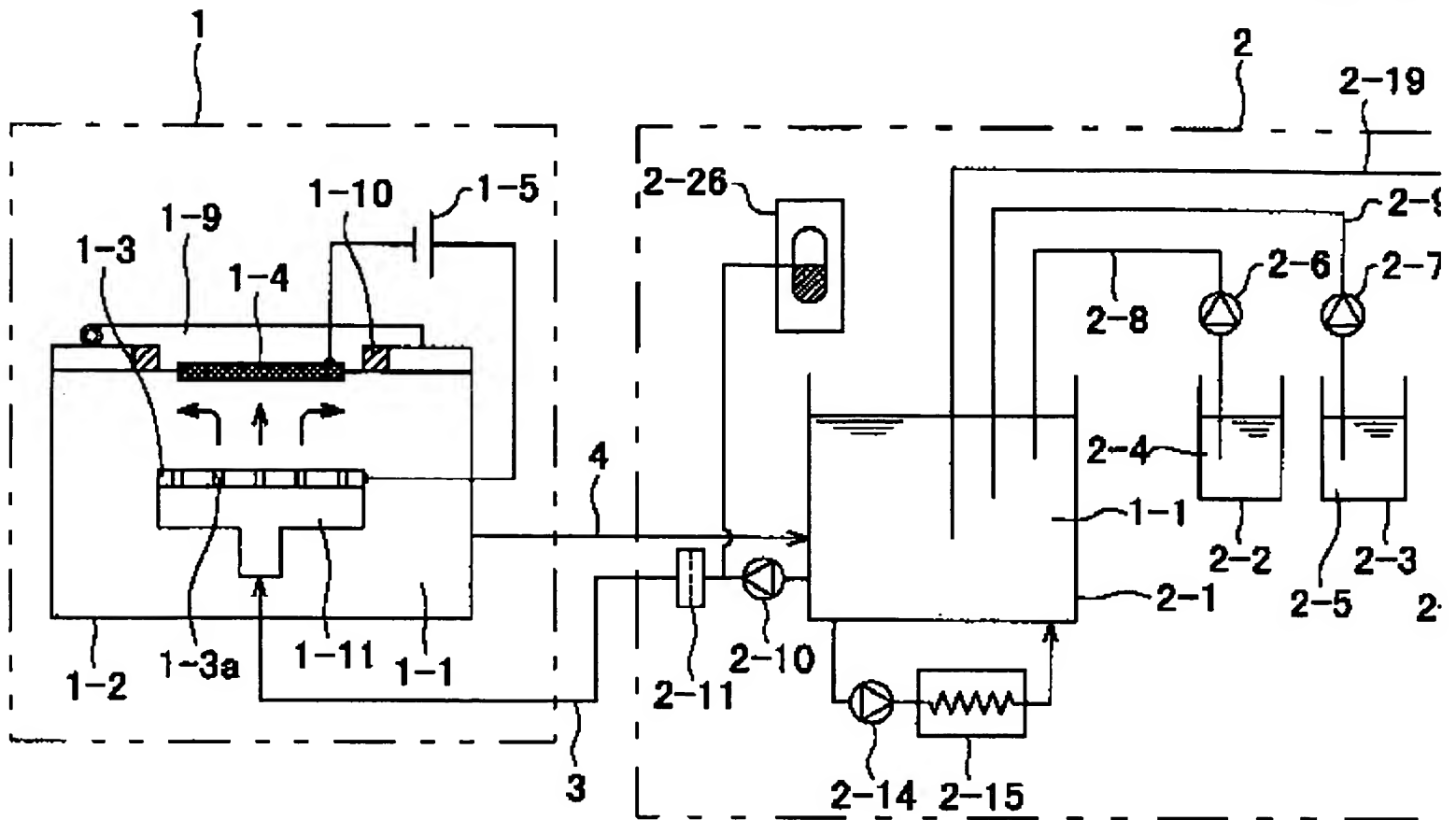
[Claim 4] The Management Department established in said 2nd room is plating equipment characterized by being one to the plating section installed in said 1st room in claim 1 thru/or plating equipment given in any 1 of 3 being plurality.

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[Translation done.]



本発明に係るめつき装置の構成例



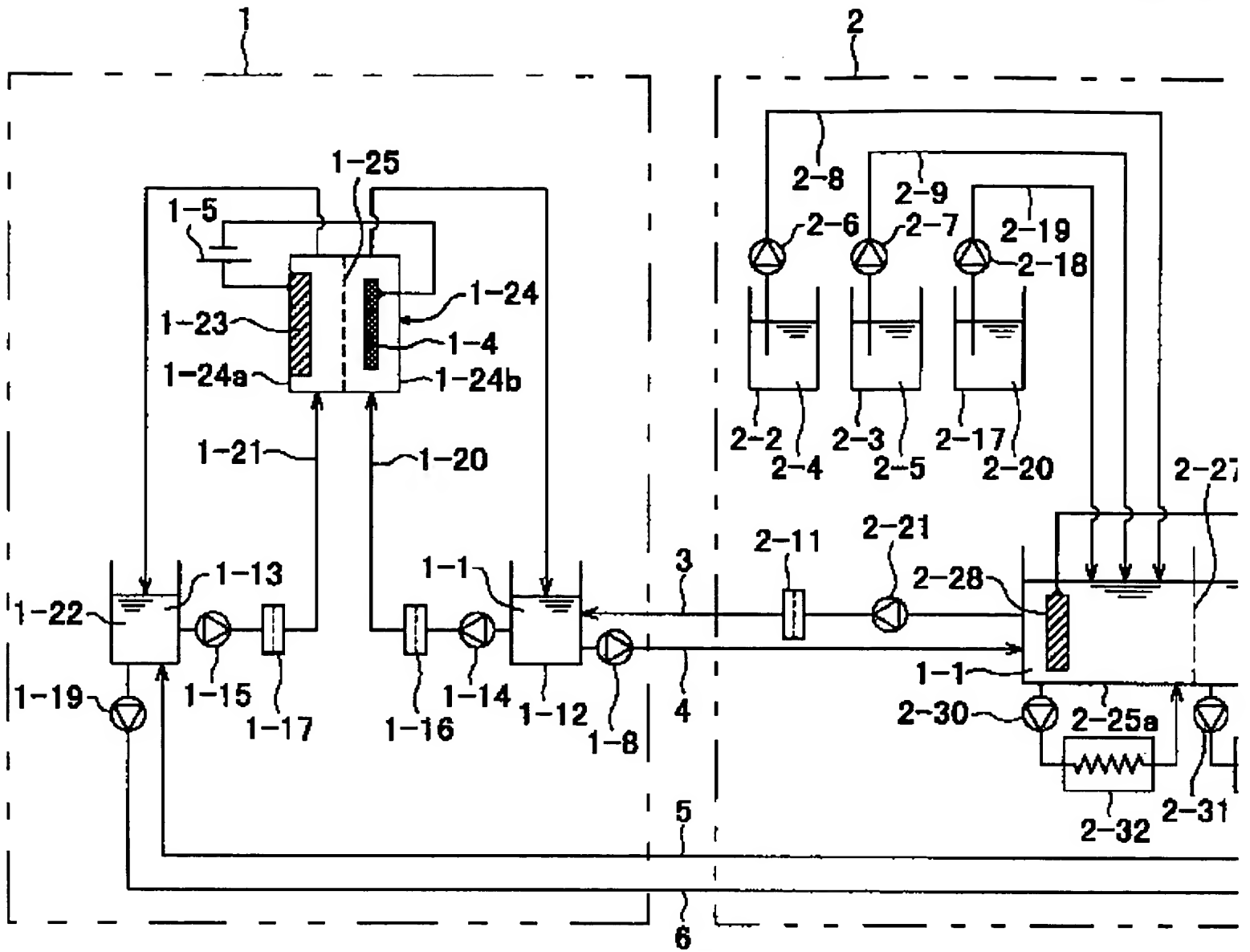
1:めっき部  
1-1:めっき液  
1-2:めっき槽  
1-3:陽極電極

1-4:被めっき基板  
1-9:基板保持具  
1-11:ケーシング

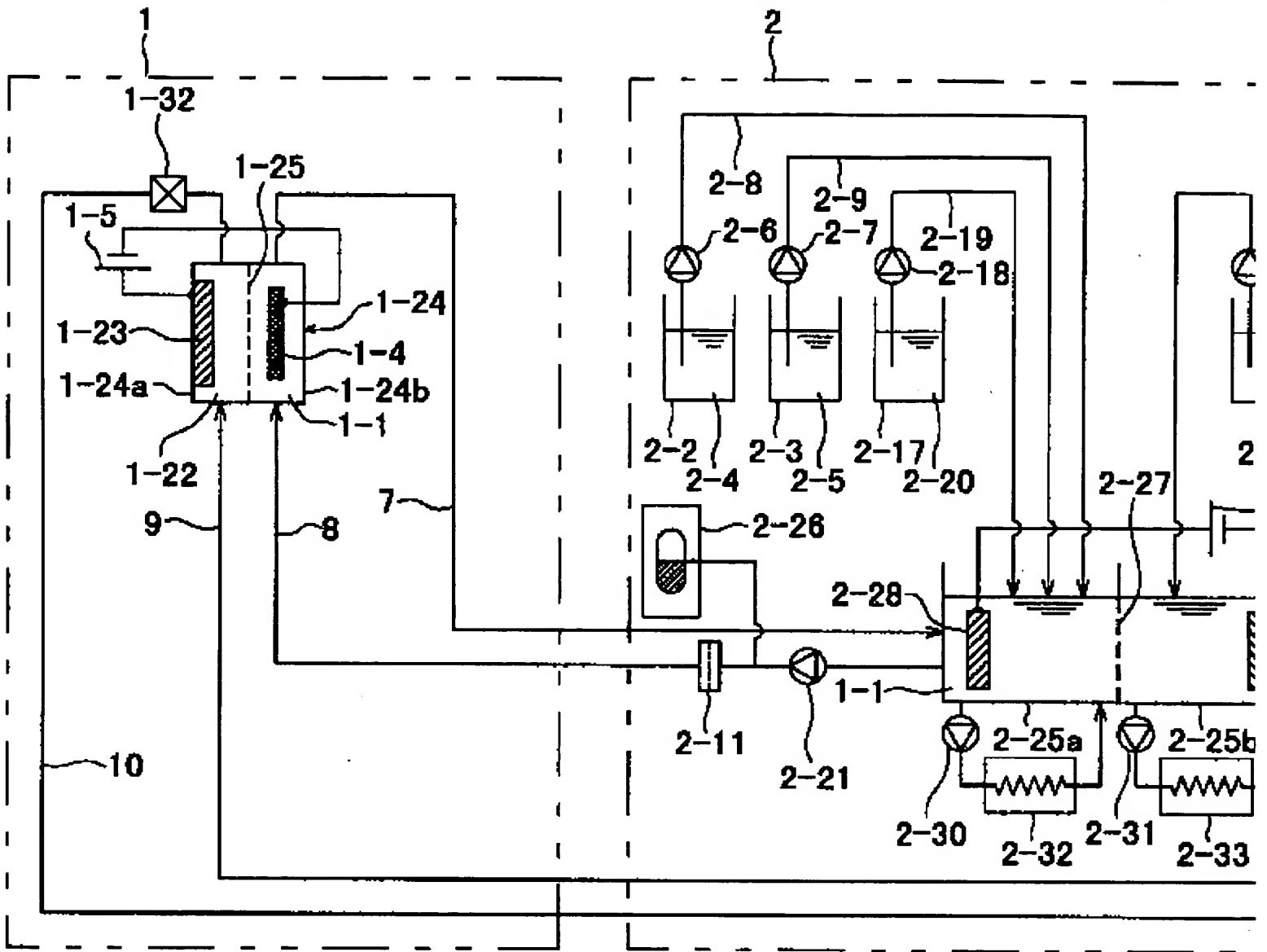
2:管理部  
2-1:調整槽  
2-2:補充槽

2-3:補充槽  
2-17:補充槽  
2-26:分析装置

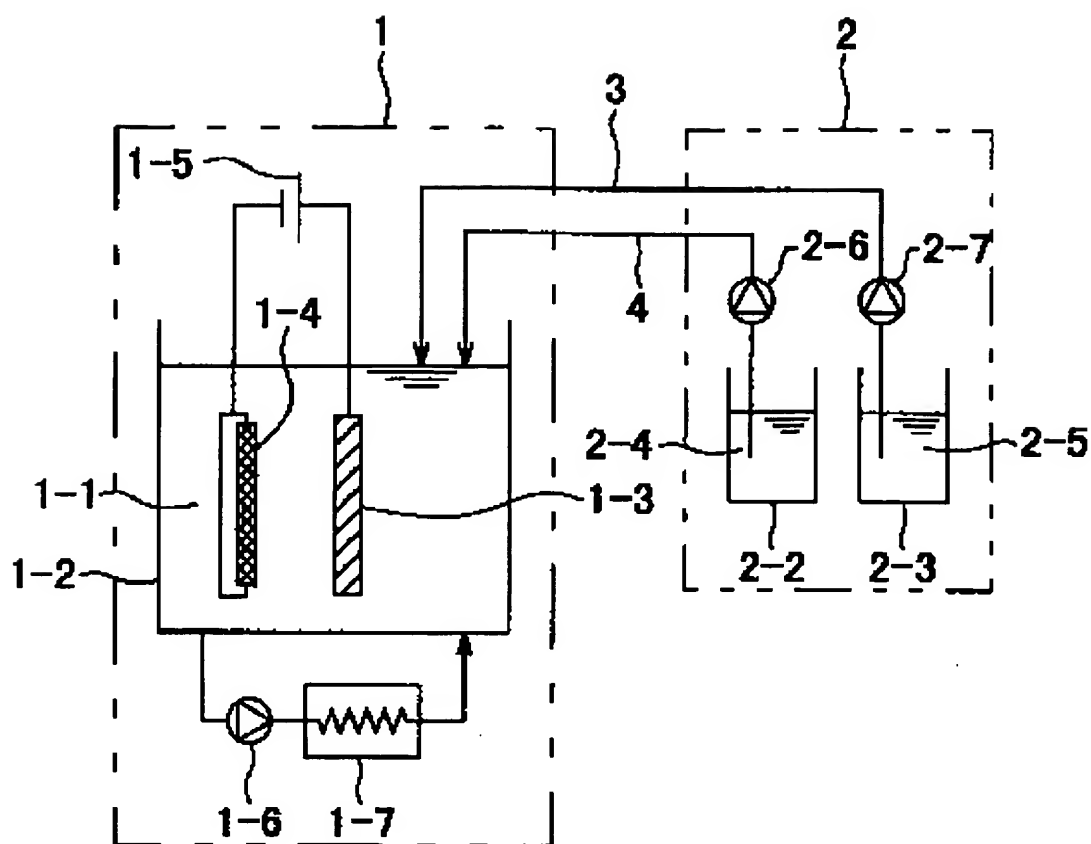
本発明に係るめっき装置の構成例



本発明に係るめつき装置の構成例

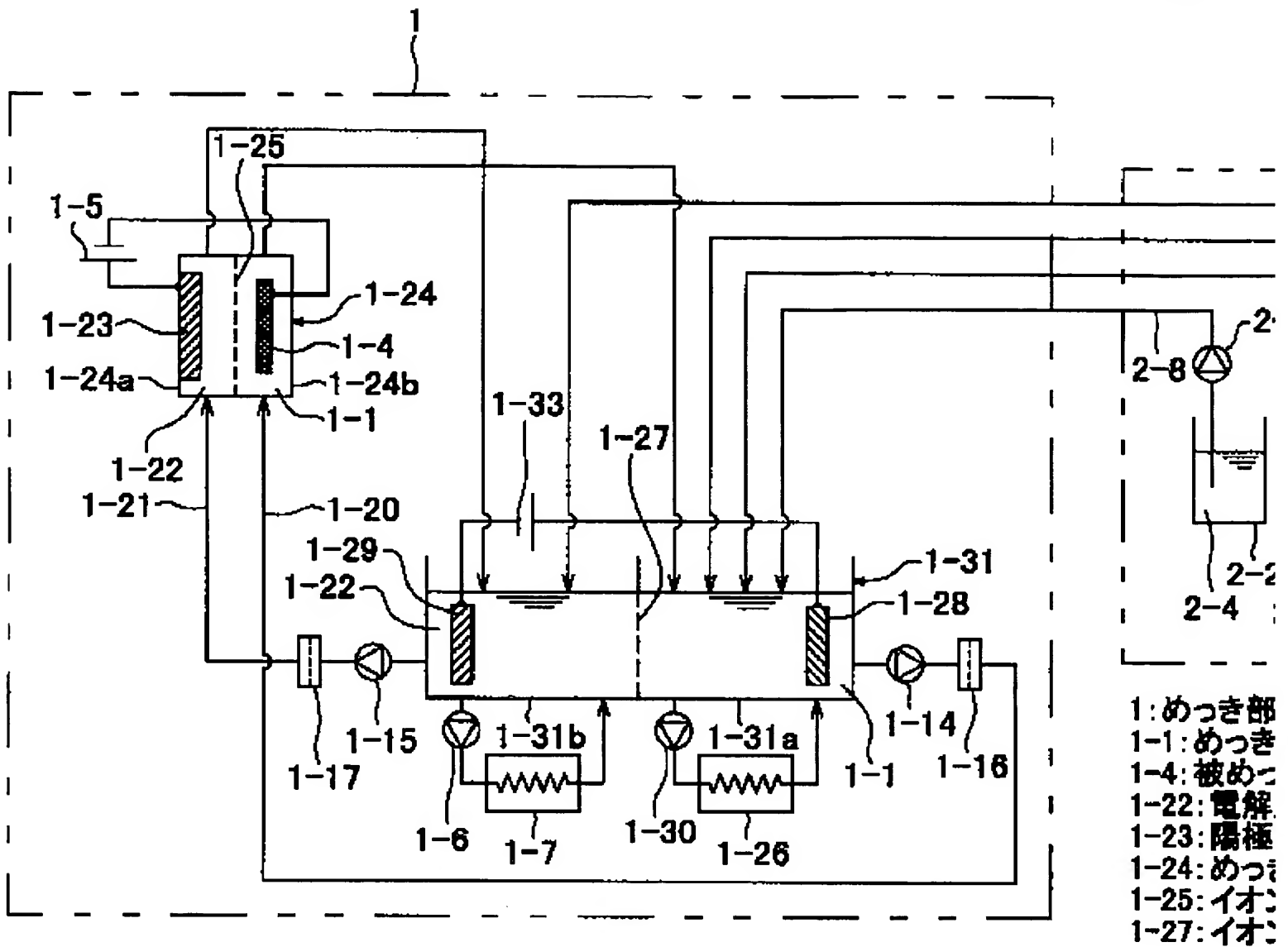


本発明に係るめっき装置の構成例



- |            |         |
|------------|---------|
| 1:めっき部     | 2:管理部   |
| 1-1:めっき液   | 2-2:補充槽 |
| 1-2:めっき槽   | 2-3:補充槽 |
| 1-3:陽極電極   |         |
| 1-4:被めっき基板 |         |

従来のめっき装置の構成例



### 従来のめっき装置の構成例